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EVALUATION OF FACTORS INFLUENCING TIME PERFORMANCES OF PLTU JERANJANG COMPLETION USING SWOT AND AHP METHODS

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ABSTRACT

Lombok is one area that has prospects of tourism development in the future. However, the optimization of Lombok as a tourist area is still hampered by a number of obstacles such as inadequate electricity infrastructure due to deficit condition. To meet the electricity demand in Lombok, PT. PLN built a steam power plant located in Jeranjang Village, Kebon Ayu. However, this power plant is not operated maximally due to many obstacles in the development process. Therefore, evaluation of the construction of the power plant needs to be performed. This evaluation is to understand the main factors causing delays in building the steam power plant.

The methods used in this research are SWOT and AHP methods. The SWOT method is used to derive alternative strategies validated by experts. AHP method is used to get the main factor causing the delay of PLTU development.

The results show that the design changes with the weight of 43.8% becoming the main factor in the completion of the project. Other influential factors are cost weighing of about 26.3%, labor force weighing of approximately 15.7%, and tools and materials weighing of 14.1%. The design change causes the cost of development projects becoming larger, so the contractor needs to make additional manpower to fit the needs of the workforce during project implementation. This has an impact on the addition of required equipment and materials. Therefore, the things that can be conducted to prevent delays are: (i) not to change the design in a large capacity of the project, and (ii) add additional hours and work to the workers.

Keywords: Electricity, SWOT, AHP.

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1. INTRODUCTION

As one of the main tourist destinations in Indonesia, Lombok still has limitations in terms of electricity infrastructure. This is due to the power supply in Lombok that is still the deficit. Currently, the Lombok electrical capacity is 230 MW. However, owing to the increased population and development in all sectors, the electrical capacity is not adequate. This experiences outages of rotating lights affecting community activities especially in the tourism sector in Lombok Island.

Furthermore, the electricity system in Lombok is almost 99.5% using PLTD as the main power plant. The price of diesel fuel, Setyawan [1], which is the main fuel of PLTD, increases, requiring the company (PT PLN) to optimize the operating system especially on the power plant side. One of PT. PLN (Persero) supports the electrical system in Lombok by building a steam power plant located in Dusun Jeranjang Village Kebon Ayu. However, although the current progress of some of the units in Jeranjang steam power plant has been reaching the test process, Jeranjang power plant is still not able to operate optimally. There are still some obstacles encountered during the process. Moreover, the process has not been completed in accordance with the schedule set. For that, this study focuses on evaluating the factors affecting the performance of the completion time of Jeranjang power plant development project. To evaluate the factors as mentioned above, some questions may arise, (1) what are the main factors affecting the timing of the completion of the Jeranjang steam power plant project?, (2) what mitigation steps should be taken on the dominant factors that most affect the timing of the completion of the Jeranjang steam power plant project?. To provide better direction and facilitate in answering the questions, two methods are used, i.e. SWOT (strengths, weaknesses, opportunities, threats) method, and AHP (analytical hierarchy process) method. SWOT is used for gaining the strategy of handling the main factors causing the project delay, while AHP is used for obtaining the main factors affecting the delays of the project completion, Al Barqouni [2]. The investigation was conducted at PLTU Jeranjang by focusing on the implementation time of the steam power plant project due to the change of the project development.

As described by Pakpahan [3], in general, time is defined as the limit given by the owner to complete the entire work. The time starts when the contractor receives instructions to start the activity and ends when the construction work on site is completed**.** Kaming [4] stated that project delays were assumed to be an extension of project execution time from the contractor's scheduled. The delay of a project has an impact on the progress of the project and the delayed activities of the project implementation.

Overall evaluation of strengths, weaknesses, opportunities and threats is called the SWOT analysis. SWOT analysis is a model that can direct and act as a catalyst in the strategic planning process[5-9]. This framework is used to build and operate or implement information from both internal and external situation analysis. Internally, this model positions the company's strengths and weaknesses, while externally, it identifies opportunities and threats faced by the company. The SWOT elements include (1) S (Strength) refers to the competitive advantage and other competitions that might affect the company on the market, (2) W (Weaknesses) indicate the barriers that overcome the choices on the development of corporate strategy, (3) O (Opportunities) provides favorable conditions that limit the barrier, and (4) T (Threats) relates to barriers or conditions that might prevent the organization from achieving its objectives. Saaty [10] defined the Analytical Hierarchy Process or abbreviated AHP, as a decision-making approach designed to help search for solutions to various problems. The end result of AHP was a ranking or weighting priority of the alternative decision-making with AHP, namely: building hierarchy, assessment and synthesis priorities**.**

2. RESEARCH METHOD

The methods used in this study were qualitative and quantitative methods. The qualitative method was performed by conducting surveys using questionnaires filled by the respondents who were competent, eligible, and experienced about the possibilities of factors impacting the timing of the development project Jeranjang power plant. While the quantitative method was to know the performance evaluation of development implementation.

Techniques of collecting data in this current study were conducted as follows:

1) Determination of respondents; Respondents in this study were respondents who had competences, experience, and positions such as the owner, consultant and contractor. From the owner of PT. PLN (Persero), the respondents were as many as 10 experts, who played a role during the work took place. From the consultant side, questionnaires were addressed to 8 respondents. While from the contractor, questionnaires were sent to 8 respondents. So the total respondents, who were included, were 26 respondents.
2) Preparation of Questionnaire. In this study, the questionnaire form employed was a closed questionnaire. The closed questionnaire consisted of closed questions, where respondents provided answers based on available options.

The use of SWOT analysis was done to analyze the internal factors of the entrepreneurs in the industrial area, so it was known as factors that became the strengths and weaknesses. Based on SWOT analysis results, selected policy alternatives are obtained. Then selected policy alternatives are analyzed to determine the selection of policy priorities by using AHP, see also [2]. This was performed because some selected alternatives generated through SWOT analysis, might not be able to be conducted simultaneously due to various limitations. The first activity undertaken in the SWOT analysis was identifications of internal and external factors, which were important stages as they were the basis for further analysis. Activities undertaken were formulating internal and external factors, which in this research was executed through literature studies on documents and related papers.

The tabulated data were analyzed by AHP method starting with the normalization of the matrix, matrix consistency calculation, hierarchical consistency and accuracy, the calculation of local values of influence, and calculation of local frequency values. The results of calculation obtained the final value of rank based on the weight.

The pairwise comparison scale and the meanings of each value introduced by Saaty [10] were as follows: 1 indicated two equally important elements, two elements with the same great influence in the decision making. 3 represents one element that was slightly more important than the other, experience and judgment were slightly supporting one element over the other. 5 was referring one element that was more important than others, experience and judgment were very strong in favor of one element over the other. 7 designated as one element that was clearly more absolutely essential than other elements, one strong element was sustained and dominant seen in practice. 9 showed one element, which was absolutely essential from other elements. The evidence that supported one element against another element was to the highest possible confirmation level. 2,4,6,8 represented values between two adjacent considerations values. This value was given when there were two compromises between the 2 options. The inverse was equal to if for activity i got one number compared with activity j, then j had the opposite value compared with i.

The calculation of mathematical formulas in AHP was done by using a matrix. For example in an operating subsystem there were n elements of operation that was A1, A2, ..., An, then the result of comparison of the elements of operation would form a comparison matrix, as explained in [2]. The result of index consistency and eigenvector of a matched

comparison matrix at a given hierarchical level was used as a basis for testing hierarchical consistency. Sensitivity analysis was a fundamental process in the decision with AHP but gets little attention from the academic literature. This analysis was used to measure the robustness of the solution and determine criteria that had relevance to the final results and were presented in the form of interactive graphics.

3. RESULTS AND DISCUSSION

The data collected by interviewing the experts began with the initial questionnaire to 26 (twenty-six) respondents namely the competent and experienced parties (experts) in the field. Furthermore, the test instrument used was the test of validity and reliability. After the data of the questionnaire were valid and reliable then the data could be analyzed further. Risk assessment analysis result obtained minor risk and a major risk. The major risk was the dominant risk of the result of the level of risk acceptance. Structured interviews using closed questionnaires were given to experts. Expert criteria were those who had at least 5 years experience in leading an agency or related field such as stakeholders, consultants, and contractors who had a good reputation education in the field of construction. The experts were 26 people consisting of 10 people from stakeholders, 8 people from contractors, and 8 people from consultant planners and supervisors. The number of questionnaires distributed was 26 (twenty-six) exemplars. The percentage of answers from respondents is given in Table 1.

Table 1 Presentage of answers from respondents

No.	Criteria	Percentage of respondent assessments (%)													Average (%)
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	
1	Cost	42	20	36	21	25	26	14	33	27	4	23	30	29	25.3
2	Manpower	8	18	7	14	25	4	9	10	9	9	30	4	8	11.9
3	Design	42	24	38	60	25	36	70	51	59	41	36	59	59	49.9
4	Tool and material	8	28	20	5	25	33	7	6	5	47	11	7	4	13.1
Consistency ratio, CR (%)		0	5	7	5	0	3	2	5	5	5	2	7	7	0.3

Based on Table 1, CR is equal to 0.3 % or less than 0.08. The value of consistency ratio was in accordance with the requirements of competence. The value obtained in the matrix was acceptable or the matrix had a good consistency.

According to the result of appraisal using AHP program application obtained, that from 4 criteria given to each responder, the dominant factor that most influence on the execution of the work of PLTU Jeranjang is design criteria, Junaidi [11], with weight equal to 43.8%. The cost criterion, see in Al-Naijar [12], becomes the second influence factor in the implementation of Jeranjang steam power plant project, which is equal to 26.3%, while for the tools and materials, the respondent gives the weight of 15.7%, and the last, for the worker, the respondent gives weight of 14.1% as shown in Fig. 1.

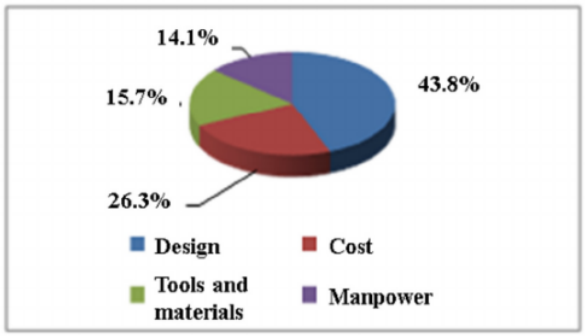

Figure 1 Percentage of the appraisal results using AHP

The result of analysis using AHP obtained cost criterion as influence factors in time of completion of development of PLTU Jeranjang of about 26.3%. The respondents explained that cost was a very important factor in the implementation of development. In the development project of PLTU Jeranjang, this indicates that there are existences of difficulties when filing the claim of the cost in case of added work. This is because the process of disbursement of funds from the owner has to go through several stages, one of which is the project must go through the audit process through BPKP.

Based on the results of data analysis, it is obtained that labor/ manpower factors become the criteria with the lowest weight, i.e. 14.1%. Respondents mentioned problems that occurred during the project took place. One of them was the lack of manpower and skilled labor. The factors of labor problems were caused by undisciplined workers with scheduled work in the environment of PLTU Jeranjang. This caused the work time to experience constraints on time. Solutions undertaken to overcome this problem was to make additional labor and make additional hours.

After analyzing the data by using AHP method, the factor that had the highest weight was Design with the weight of 43.8%. The design was the most dominant factor that caused the project completion time to be inconsistent with the initial schedule. The respondents revealed that the delay in the completion of the development of the Jeranjang power plant was the impact of the design changes that often occur. Design changes occurred due to the displacement of the location of power plant construction which originally located in the Endok region moved to the area of Jeranjang.

Respondents also revealed some design changes. Those were changing access road routes to project sites located on the coast of Jeranjang, changing the pile volume, changing the length of the intake pipes for cooling, and some other design changes. Most of the changes took place during project implementation. This, of course, had an impact on schedule changes, the scope of work, and the sequence of work, labor and cost issues.

The tools and materials had a third order weighted result of 15.7% after design and cost. Problems of tools and materials that became factors affecting the completion time of the development of PLTU Jeranjang were:

1. In case of damage, the process of delivery of equipment took a long time. The tools used were tools originating from China according to the contract of work. Estimated duration of delivery time was 1-month shipment
2. Delivery of coal fuel, which often experienced weather constraints at the time of delivery from Kalimantan, lacked of material.

The factor of design change was the most influential factor in the completion of the development of the Jeranjang power plant. The results of the analysis were then used as a comparison of answers from the results of expert interviews. Validation results with expert interviews showed that basically, the most dominant thing that influenced the completion of the work of PLTU Jeranjang was due to the design change, the shift of the location of development, and the addition of the design at the time of development carried out. This was conveyed by the consultants and contractors who were competent and directly involved in developing the steam power plant. As a result of this design change, other delay factors arose that were the impact of the changes and the addition of designs that occurred in PLTU Jeranjang. Changes and the addition of the design that happened were what experts said to be the root of the problem of completion of the construction of the project PLTU Jeranjang. This caused the construction project to become swollen, so the contractor required to increase the workforce to match the labor needs of the project, as proper human resource management of project management would affect the completion of the project target. A large number of workers was not necessarily effective in implementing the project, and vice versa, the shortage of labor would affect project delays and automatically disturbed the project on the needs of the tools and materials used during construction, Putri [13].

Based on the results of AHP analysis and validation with the experts, i.e. the consultants and contractors who involved the development of PLTU Jeranjang, the dominant factor that most influenced the completion of the development of PLTU Jeranjang was the factor of design change. As for the validation results of AHP analysis and interviews, the respondents provided several solutions to overcome several factors that affected the completion time of the development of the Jeranjang power plant.

1) Established mature planning and planning specifications before the project was executed, so that cost swelling could be minimized. This was justified by consultants and contractors who were involved in the construction of PLTU Jeranjang.
2) The need for additional labor, if it turned out difficult changes to be handled during the project. The contractor required to increase the number of more competent and experienced workers in the construction project because proper human resource management on project management would affect the completion of the project targets, Firmansyah [14].
3) Increased working hours (Overtime) of the workforce with due regard to the rights and needs of workers, Elinwa and Joshua [15].

4. CONCLUSION

Based on the results of analysis and discussion, some conclusion can be summarized as follows:

1. The criteria considered as the most dominant in this study based on the results of the analysis using SWOT and AHP method are the design with a weight of 43.8%, costs, tools and materials, and labor weights of 26.30%, 15.7%, and 14.1% respectively.
2. The most influential factor in the implementation of the construction of the Jerangjang power plant is the design factor. Where in this criteria, there are design changes resulting from land changes, design changes by the owner, changes in specifications at the time of the project, and additional factors. These are the main factors that hinder the completion of the project.
3. Mitigation actions that need to be done are: prevention; establish design and planning specifications before the project is implemented, so that the cost swelling can be minimized; the need for additional labor if it turns out difficult changes to be handled

during the project; the contractor needs to increase the workforce to adjust the project implementation, as proper human resource management on project management affects the completion of the project targets; increase working hours (overtime) of the workforce; timely payment by owner to contractor.

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